AD-A102 675 NEW JERSEY DEPT OF ENVIRONMENTAL PROTECTION TRENTON --ETC F/G 13/13
NATIONAL DAM SAFETY PROGRAM. LEBANON LAKE DAM (NJ 00812), DELAW--ETC(U)
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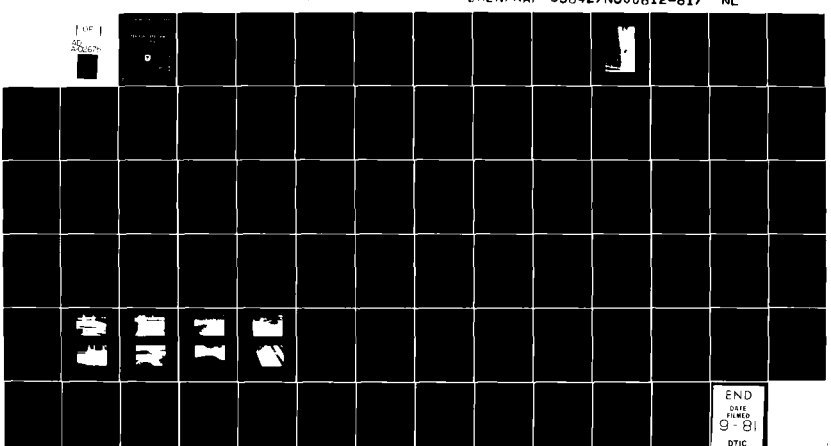

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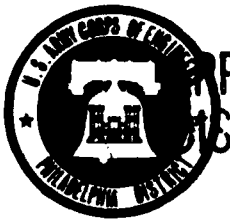
DELAWARE RIVER BASIN
BISPHAMS MILL CREEK
BURLINGTON COUNTY
NEW JERSEY

LEBANON LAKE DAM

NJ 00812

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM



DEPARTMENT OF THE ARMY
Philadelphia District
Corps of Engineers
Philadelphia, Pennsylvania

REPT. NO: DAENINAP - 53842/NJ00812 - 81/07

JULY 1981

National Dam Safety Program. Lebanon Lake Dam (NJ 00812), Delaware River Basin, Bisphams Mill Creek, Burlington County, New Jersey. Phase I Inspection Report.

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

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17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

Copies are obtainable from National Technical Information Service, Springfield, Virginia 22151.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Dams	National Dam Safety Program	Erosion
Embankments	Lebanon Lake Dam, NJ	Spillway
Visual Inspection	Bisphams Mill Creek, NJ	
Structural Analysis	Delaware River Basin	

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report cites results of a technical investigation as to the dam's adequacy. The inspection and evaluation of the dam is as prescribed by the National Dam Inspection Act, Public Law 92-367. The technical investigation includes visual inspection, review of available design and construction records, and preliminary structural and hydraulic and hydrologic calculations, as applicable. An assessment of the dam's general condition is included in the report.

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
CUSTOM HOUSE - 2D & CHESTNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

NAPEN-N

30 JUL 1981

Honorable Brendan T. Byrne
Governor of New Jersey
Trenton, New Jersey 08625

Dear Governor Byrne:

Inclosed is the Phase I Inspection Report for Lebanon Lake in Burlington County, New Jersey which has been prepared under authorization of the Dam Inspection Act, Public Law 92-367. A brief assessment of the dam's condition is given in the front of the report.

Based on visual inspection, available records, calculations and past operational performance, Lebanon Lake Dam, initially listed as a high hazard potential structure, but reduced to a significant hazard potential structure as a result of this inspection, is judged to be in good overall condition. The dam's spillway is considered inadequate because a flow equivalent to 92 percent of the Spillway Design Flood (SDF) would cause the dam to be overtopped. To ensure the adequacy of the structure, the following actions, as a minimum, are recommended:

a. The spillway's adequacy should be determined by a qualified professional consultant engaged by the owner using more sophisticated methods, procedures and studies within six months from the date of approval of this report. Within three months of the consultant's findings remedial measures to ensure spillway adequacy should be initiated.

b. Within six months from the date of approval of this report the following remedial actions should be initiated:

(1) Eroded areas on the upstream and downstream faces of embankment caused by wave erosion should be filled and stabilized.

(2) Eroded areas adjacent to the right side of the spillway should be filled and stabilized.

(3) Partially rotted timber cap on the left spillway training wall should be replaced or repaired as necessary.

(4) Trees and adverse vegetation on the embankment should be removed.

(5) The ability to drain the lake should be investigated by a professional engineer experienced in the design and construction of dams. If necessary, the outlet works should be restored to proper operational condition or replaced.

c. The owner should develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam, within one year from the date of approval of this report.

d. An emergency action plan and warning system should be developed which outlines actions to be taken by the owner to minimize the downstream effects of an emergency at the dam within six months from the date of approval of this report.

A copy of the report is being furnished to Mr. Dirk C. Hofman, New Jersey Department of Environmental Protection, the designated State Office contact for this program. Within five days of the date of this letter, a copy will also be sent to Congressman Forsythe of the Sixth District. Under the provision of the Freedom of Information Act, the inspection report will be subject to release by this office, upon request, five days after the date of this letter.

Additional copies of this report may be obtained from the National Technical Information Services (NTIS), Springfield, Virginia 22161 at a reasonable cost. Please allow four to six weeks from the date of this letter for NTIS to have copies of the report available.

An important aspect of the Dam Inspection Program will be the implementation of the recommendations made as a result of the inspection. We accordingly request that we be advised of proposed actions taken by the State to implement our recommendations.

Sincerely,

ROGER L. BALDWIN
Lieutenant Colonel, Corps of Engineers
Commander and District Engineer

1 Incl
As stated

Copies furnished:
Mr. Dirk C. Hofman, P.E., Deputy Director
Division of Water Resources
N.J. Dept. of Environmental Protection
P.O. Box CN029
Trenton, NJ 08625

Mr. John O'Dowd, Acting Chief
Bureau of Flood Plain Regulation
Division of Water Resources
N.J. Dept. of Environmental Protection
P.O. Box CN029
Trenton, NJ 08625

LEBANON LAKE DAM (NJ00812)

CORPS OF ENGINEERS ASSESSMENT OF GENERAL CONDITIONS

This dam was inspected on 27 and 30 April 1981 by Storch Engineer, under contract to the State of New Jersey. The State, under agreement with the U.S. Army Engineer District, Philadelphia, had this inspection performed in accordance with the National Dam Inspection Act, Public Law 92-367.

Lebanon Lake Dam, initially listed as a high hazard potential structure, but reduced to a significant hazard potential structure as a result of this inspection, is judged to be in good overall condition. The dam's spillway is considered inadequate because a flow equivalent to 92 percent of the Spillway Design Flood (SDF) would cause the dam to be overtopped. To ensure the adequacy of the structure, the following actions, as a minimum, are recommended:

a. The spillway's adequacy should be determined by a qualified professional consultant engaged by the owner using more sophisticated methods, procedures and studies within six months from the date of approval of this report. Within three months of the consultant's findings remedial measures to ensure spillway adequacy should be initiated.

b. Within six months from the date of approval of this report the following remedial actions should be initiated:

(1) Eroded areas on the upstream and downstream faces of embankment caused by wave erosion should be filled and stabilized.

(2) Eroded areas adjacent to the right side of the spillway should be filled and stabilized.

(3) Partially rotted timber cap on the left spillway training wall should be replaced or repaired as necessary.

(4) Trees and adverse vegetation on the embankment should be removed.

(5) The ability to drain the lake should be investigated by a professional engineer experienced in the design and construction of dams. If necessary, the outlet works should be restored to proper operational condition or replaced.

c. The owner should develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam, within one year from the date of approval of this report.

d. An emergency action plan and warning system should be developed which outlines actions to be taken by the owner to minimize the downstream effects of an emergency at the dam within six months from the date of approval of this report.

APPROVED: Roger Baldwin

ROGER L. BALDWIN
Lieutenant Colonel, Corps of Engineers
Commander and District Engineer

DATE: 30 July 81

PHASE I REPORT
NATIONAL DAM SAFETY REPORT

Name of Dam:	Lebanon Lake Dam, I.D. NJ00812
State Located:	New Jersey
County Located:	Burlington
Drainage Basin:	Delaware River
Stream:	Bisphams Mill Creek
Dates of Inspection:	April 27, 1981
	April 30, 1981

Assessment of General Condition of Dam

Based on visual inspection, past operational performance and Phase I engineering analyses, Lebanon Lake Dam is assessed as being in good overall condition.

Based on investigations of the downstream flood plain made in connection with this report, it is recommended that the hazard potential classification be downgraded from high to significant hazard.

Hydraulic and hydrologic analyses indicate that the spillway is inadequate. Discharge from the spillway is not sufficient to pass the designated spillway design flood (100-year storm) without an overtopping of the dam. The spillway is capable of passing approximately 91 percent of the SDF. Therefore, the owner should engage a professional engineer experienced in the design and construction of dams in the near future to perform more accurate hydraulic and hydrologic analyses relating to spillway capacity. Based on the findings of the analyses, the need for and type of remedial measures should be determined and then implemented.

The owner should, in the near future, develop an emergency action plan together with an effective warning system outlining actions to be taken by the operator to minimize downstream effects of an emergency at the dam.

In addition, it is recommended that the following remedial measures be undertaken by the owner in the near future.

1) Eroded areas on the upstream and downstream faces of embankment caused by wave erosion should be filled and stabilized.

2) Eroded areas adjacent to the right side of the spillway should be filled and stabilized.

3) Partially rotted timber cap on the left spillway training wall should be replaced or repaired as necessary.

4) Trees and adverse vegetation on the embankment should be removed.

5) The ability to drain the lake should be investigated by a professional engineer experienced in the design and construction of dams. If necessary, the outlet works should be restored to proper operational condition or replaced.

In the future, the owner of the dam should develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam.

Richard J. McDermott, P.E.

John E. Gribbin, P.E.

OVERVIEW - LEBANON LAKE DAM

27 APRIL 1981

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. It is important to note that the condition of dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that the unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydraulic and hydrologic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydraulic and hydrologic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

LEBANON LAKE DAM, I.D. NJ00812

SECTION 1: PROJECT INFORMATION

1.1 General

a. Authority

Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspections throughout the United States. The Division of Water Resources of the New Jersey Department of Environmental Protection (NJDEP) in cooperation with the Philadelphia District of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the State of New Jersey. Storch Engineers has been retained by the NJDEP to inspect and report on a selected group of these dams. The NJDEP is under agreement with the Philadelphia District of the Corps of Engineers.

b. Purpose of Inspection

The visual inspections of Lebanon Lake Dam were made on April 27 and April 30, 1981. The purpose of the inspections was to make a general assessment of the structural integrity and operational adequacy of the dam structure and its appurtenances.

1.2 Description of Project

a. Description

The dam consists of an earth embankment with a free overflow spillway and a gated outlet works. The spillway, located near the right end of the dam, consists of a two-stage concrete weir with vertical upstream face and inclined downstream face. The spillway abutments or training walls are formed by treated timber walls.

The outlet works, located near the center of the dam consists of a gated 48-inch pipe which transversely penetrates the dam embankment. A square concrete manhole containing gate and operating mechanism is located at the center of the embankment.

The elevation of the primary spillway crest is 86.2 National Geodetic Vertical Datum (N.G.V.D.) while that of the secondary crest is 86.4. The crest of the dam is at elevation 90.0 while that of the lake bed located immediately downstream is 80.0. The overall length of the dam is 925 feet and its height is 10.0 feet. The top width of the dam varies from 15 feet to 27 feet. The slope of the downstream face is approximately 3 horizontal to 1 vertical while that of the upstream face is approximately 2 horizontal to 1 vertical.

b. Location

Lebanon Lake Dam is located in the Township of Woodland, Burlington County, New Jersey. It impounds a recreational lake located approximately 500 feet south of N.J. Route 70. Principal access to the dam is by way of a public road in the Lebanon Lake Estates residential development. Discharge from the spillway of the dam flows into Bisphams Mill Creek.

c. Size and Hazard Classification

The dam is classified in accordance with criteria presented in "Recommended Guidelines for Safety Inspection of Dams" published by the U.S. Army Corps of Engineers. Size categories consist of Small, Intermediate and Large while hazard categories are designated as Low, Significant and High.

Size Classification: Lebanon Lake Dam is classified as "Small" size since its maximum storage volume is 281 acre-feet (which is less than 1000 acre-feet) and its height is 10.0 feet (which is less than 40 feet).

Hazard Classification: Visual inspection of the downstream flood plain of the dam indicates that failure of the dam would not inundate dwellings located along two lakes immediately downstream from the dam. However, road bridges located 500 feet and 1.8 miles downstream from the dam could be damaged as a result of dam failure. Also, dams located 500 feet, 2000 feet and 3200 feet downstream from the subject dam could be damaged. Accordingly, Lebanon Lake Dam is classified as "Significant" hazard.

d. Ownership

Lebanon Lake Dam is owned by Mr. John Gouryeb, P.O. Box 7780, R.D. #7, Browns Mills, N.J. 08015.

e. Purpose of Dam

The purpose of the dam is the impoundment of a private recreational lake facility.

f. Design and Construction History

Lebanon Lake Dam reportedly was constructed in or about 1957. The construction work was done by the Logan Construction Co. (spillway) and Russell Anderson (embankment) under contract to the owner.

Reportedly, the dam was constructed with treated timber piling driven in the center of the embankment in an area which extends approximately 200 feet on both sides of the spillway structure. Also the dam was reportedly constructed with a clay core. Verification of this reported type of construction could not be obtained.

Reportedly no records or plans for the construction of the original dam are available.

g. Normal Operational Procedures

Reportedly, the outlet works is not used to augment the spillway capacity. The owner lowers the lake level approximately 2 feet every two or three years for the purpose of beach maintenance.

The dam and appurtenances are maintained and repaired on an "as needed" basis.

1.3 Pertinent Data

a.	Drainage area	10.66 square miles
b.	Discharge at Damsite	
	Maximum flood at damsite	Unknown
	Outlet works at pool elevation	120 c.f.s
	Spillway capacity at top of dam	937 c.f.s.

c. Elevation (N.G.V.D.)

Top of Dam	90.0
Maximum pool-design surcharge	90.1
Recreation pool	86.4
Spillway crest - Primary	86.2
- Secondary	86.4
Stream bed at toe of dam	80.0
Maximum tailwater	85.1(downstream lake level during 100-year storm)

d. Reservoir

Length of maximum pool	2500 feet (Estimated)
Length of recreation pool	2000 feet (Scaled)

e. Storage (Acre-feet)

Recreation pool	110
Design surcharge	284
Top of dam	281

f. Reservoir Surface (acres)

Top of dam	65.0 (Estimated)
Maximum Pool Design - design surcharge	67.5 (Estimated)
Recreation Pool	31.8

g. Dam

Type	Earthfill
Length	925 feet
Height	10.0 feet

Sideslopes - Upstream	2 horiz. to 1 vert.
- Downstream	3 horiz. to 1 vert.
Zoning	Unknown
Impervious core	Reportedly, Clay Core
Cutoff	Reportedly treated Timber piling extends approx. 200 feet from both sides of the spillway in center of embankment
Grout curtain	Unknown

h. Diversion and Regulating Tunnel — Gated 48-inch diameter gated low level outlet pipe

i. Spillway

Type	Uncontrolled weir
Length of weir - primary	15 feet
- secondary	30 feet
Crest elevation - primary	86.2
-secondary	86.4
Gates	N.A.
Upstream channel	Timber Training Walls
Downstream channel	Natural Lake

j. Regulating Outlet

Gated 48-inch diamater low level outlet pipe

SECTION 2: ENGINEERING DATA

2.1 Design

No plans or calculations pertaining to the ori l design of the dam could be obtained.

2.2 Construction

No data or reports pertaining to the original construction of the dam are available. Reportedly, the dam embankment was constructed with a clay core and treated timber pilings were driven through the center of the dam extending for a distance of approximately 200 feet on either side of the spillway.

2.3 Operation

There are no formal maintenance reports pertaining to the operation of the dam.

2.4 Evaluation

a. Availability

No data or reports pertaining to the operations of the dam could be obtained.

b. Adequacy

Available engineering data pertaining to Lebanon Lake Dam is not adequate to be of significant assistance to the performance of a Phase I evaluation. A list of absent information is included in paragraph 7.1.b.

c. Validity

The validity if engineering data cannot be assessed due to the absence of data.

SECTION 3: VISUAL INSPECTION

3.1 Findings

a. General

The inspections of Lebanon Lake Dam were performed on April 27 and 30, 1981 by staff members of Storch Engineers. A copy of the visual inspection check list is contained in Appendix 1. The following procedures were employed for the inspection:

1) The embankment of the dam, appurtenant structures and adjacent areas were examined.
2) The embankment and accessible appurtenant structures were measured and key elevations determined by surveyor's level.
3) The embankment, appurtenant structures and adjacent areas were photographed.
4) The downstream flood plain was toured to evaluate downstream development and restricting structures.

b. Dam

The crest of the dam appeared to be uniformly graded with a generally bare and sandy crest. A few sparse patches of grass were observed on the crest. The upstream and downstream faces of the dam were generally covered with sparse patches of grass and some trees. Tree calipers ranged between 1 inch and 8 inches.

Some erosion was observed at the junction of the embankment and the right side of the spillway on the upstream face of the dam. In addition, the entire length of the upstream face of the dam appeared eroded at the waterline apparently due to wave erosion. An erosion gully was observed on the downstream face of the dam immediately to the right of the spillway. No

evidence of riprap was observed on the embankment. Seepage could not be properly evaluated since the entire toe of the dam was submerged by tailwater due to the presence of the lake located immediately downstream.

c. Appurtenant Structures

The timbers which comprise the spillway abutments were observed to be in generally satisfactory condition with the exception of the timber cap which appeared to be slightly rotted.

The concrete forming the two stage triangular shaped weir of the spillway appeared to be in generally satisfactory condition.

The 48-inch diameter conduit serving as the low level outlet works was completely submerged at the time of inspection and could not be observed. The square concrete manhole which serves as the housing for the operating mechanism appeared to be in good condition. The gate for the outlet pipe was not observed as it was also completely submerged. The gate operating mechanism and stem were observed to be in a rusted condition, but the mechanism appeared to be in generally satisfactory condition.

d. Reservoir Area

The reservoir has thickly wooded shores with generally flat to moderate shore slopes between 1 and 5 percent. The upstream portion of the reservoir appeared shallow as evidenced by exposed tree stumps. A beach area and firehouse were observed on the right shoreline near the dam embankment.

e. Downstream Channel

A small lake is located immediately downstream from the dam embankment and the entire downstream toe of the dam is submerged.

Discharge from the dam flows directly into the downstream lake. The shores of the downstream lake are generally wooded and the slopes are flat. A concrete roadbridge for N.J. Route 70 is located at the downstream end of the downstream lake. Downstream from Route 70, discharge flows through Presidential Lake and then into Bisphams Mill Creek.

SECTION 4: OPERATIONAL PROCEDURES

4.1 Procedures

The level of water in Lebanon Lake is regulated by discharge over the concrete spillway. Reportedly, the outlet works of the dam can be used to drain the lake but normally is not used to augment the discharge capacity of the spillway. Normally the owner lowers the lake level by approximately two feet every two or three years for the purpose of beach maintenance. The most recent drawdown of the lake occurred in 1978 when the owner siphoned down the lake a total of two to three feet for the purpose of beach maintenance. The lake can be drawn down only to the level of the lake located immediately downstream. At the time of our inspection Lebanon Lake could be drawn down a maximum of approximately four feet.

4.2 Maintenance of the Dam

Reportedly, maintenance is performed on an "as needed" basis.

4.3 Maintenance of Operating Facilities

Reportedly, maintenance of operating facilities is performed on an "as needed" basis.

4.4. Description of Warning System

Reportedly, no warning system is currently in use for the dam.

4.5 Evaluation of Operational Adequacy

The operation of the dam has been successful to the extent that the dam reportedly has not been overtopped since its construction in 1957.

Although maintenance has been adequate in some areas, some aspects of dam maintenance have not been satisfactorily performed, including the following:

1) Eroded areas on upstream and downstream face of the embankment not stabilized.
2) Rotted timber cap on the left spillway abutment not repaired or replaced.
3) Trees on upstream and downstream faces of the embankment not removed.
4) Outlet works not functioning properly.

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design Data

The quantity of storm water runoff that the spillway should be able to handle is based on the size and hazard classification of the dam. This runoff quantity, called the spillway design flood (SDF) is described in terms of return frequency or Probable Maximum Flood (PMF) depending on the extent of the dam's size and potential hazard. According to the "Recommended Guidelines for Safety Inspection of Dams" published by the U.S. Army Corps of Engineers, the SDF for Lebanon Lake Dam falls in a range of 100-year storm to 1/2 PMF. In this case, the low end of the range, 100-year storm, is chosen since the factors used to select size and hazard classification are on the low side of their respective ranges.

The SDF peak computed for Lebanon Lake Dam is 1032 c.f.s. This value is derived from the 100-year flood hydrograph computed by the use of the HEC-1-DAM Flood Hydrograph Computer Program using Clark's unit hydrograph parameters. Hydrologic computations and computer output are contained in Appendix 4.

The spillway discharge rates were computed by the use of a weir formula appropriate for the configuration of the spillway structure. The total spillway discharge with lake level equal to the top of the dam was computed to be 937 c.f.s. The SDF was routed through the dam by use of the HEC-1-DAM computer program using the modified Puls Method. In routing the SDF, it was found that the dam crest would be overtopped by a depth of 0.1 foot. Accordingly, the subject spillway is assessed as being inadequate in accordance with criteria developed by the U.S. Army Corps of Engineers.

b. Experience Data

Reportedly, the dam has not been overtopped since its construction.

c. Visual Observation

Some erosion was observed on the downstream side of the embankment although it was not considered to be an indication of overtopping.

d. Overtopping Potential

As indicated in paragraph 5.1.a. a storm of magnitude equal to the SDF would cause overtopping of the dam by a of 0.1 foot over the crest of the dam. The spillway is capable of passing approximately 91 percent of the SDF with the lake level equal to the top of dam.

e. Drawdown Data

Drawdown of the lake is accomplished by opening the gated 48-inch pipe which forms the low-level outlet works. Total estimated time of drawdown is calculated to be 19 hours (See Appendix 4).

SECTION 6: STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

The dam appeared, at the time of inspection to be outwardly structurally sound with no evidence of embankment cracks or distress.

b. Generalized Soils Description

The dam is located in a flat lowlands composed of recent alluvial deposited in a poorly drained, swampy condition. Elevated mounds, associated with the Bridgetown formation, borders the lowlands stripe, northwards and southwards. The soil material is a uniform sand and silty sand with some gravel scattered throughout the profile.

c. Design and Construction Data

Analysis of structural stability and construction data for the embankment are not available.

d. Operating Records

No operating records are available for the dam. The water level of Lebanon Lake is not monitored.

e. Post-Construction Changes

Reportedly, it is not known whether or not there have been any post-construction changes. No evidence of significant post-construction changes was noted at the times of inspection.

f. Seismic Stability

Lebanon Lake Dam is located in Seismic Zone 1 as defined in "Recommended Guidelines for Safety Inspection of Dams" which is a zone of very low seismic activity. Experience indicates that dams in Seismic Zone 1 will have adequate stability under seismic loading conditions if they have adequate stability under static loading conditions. Lebanon Lake Dam appeared to be stable at the times of inspection.

SECTION 7: ASSESSMENT AND RECOMMENDATIONS

7.1 Dam Assessment

a. Safety

Based on hydraulic and hydrologic analyses outlined in Section 5 and Appendix 4, the spillway of Lebanon Lake Dam is assessed as being inadequate. The spillway is not able to pass the SDF without an overtopping of the dam.

The embankment appeared, at the time of inspection, to be generally outwardly stable.

b. Adequacy of Information

Information sources for this report include 1) field inspections, 2) USGS quadrangle, 3) consultation with the owner. The information obtained is sufficient to allow a Phase I assessment as outlined in "Recommended Guidelines for Safety Inspection of Dams."

Some of the absent data are as follows:

1. Construction and as-built drawings.
2. Description of fill material for embankment.
3. Design computations and reports.
4. Soils report for the site.
5. Maintenance documentation.
6. Post-construction engineering reports.

c. Necessity for Additional Data/Evaluation

Although some data pertaining to Lebanon Lake Dam are not available, additional data are not considered imperative for this Phase I evaluation.

7.2 Recommendations

a. Remedial Measures

Based on hydraulic and hydrologic analyses outlined in paragraph 5.1.a, the spillway is considered to be inadequate. It is therefore recommended that a professional engineer experienced in the design and construction of dams be engaged in the near future to perform more accurate hydraulic and hydrologic analyses relating to spillway capacity. Based on the findings of these analyses, the need for and type of remedial measures should be determined and then implemented.

The owner should, in the near future, develop an emergency action plan together with an effective warning system outlining actions to be taken by the operator to minimize downstream effects of an emergency at the dam.

In addition, it is recommended that the following remedial measures be undertaken by the owner in the near future.

1) Eroded areas on the upstream and downstream faces caused by wave erosion of embankment should be filled and stabilized.
2) Eroded areas adjacent to the right side of the spillway should be filled and stabilized.
3) Partially rotted timber cap on the left spillway training wall should be replaced or repaired as necessary.
4) Trees and adverse vegetation on the embankment should be removed.
5) The ability to drain the lake should be investigated by a professional engineer experienced in the design and construction of dams. If necessary, the outlet works should be restored to proper operational condition or replaced.

b. Maintenance

In the future, the owner of the dam should develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam.

PLATES

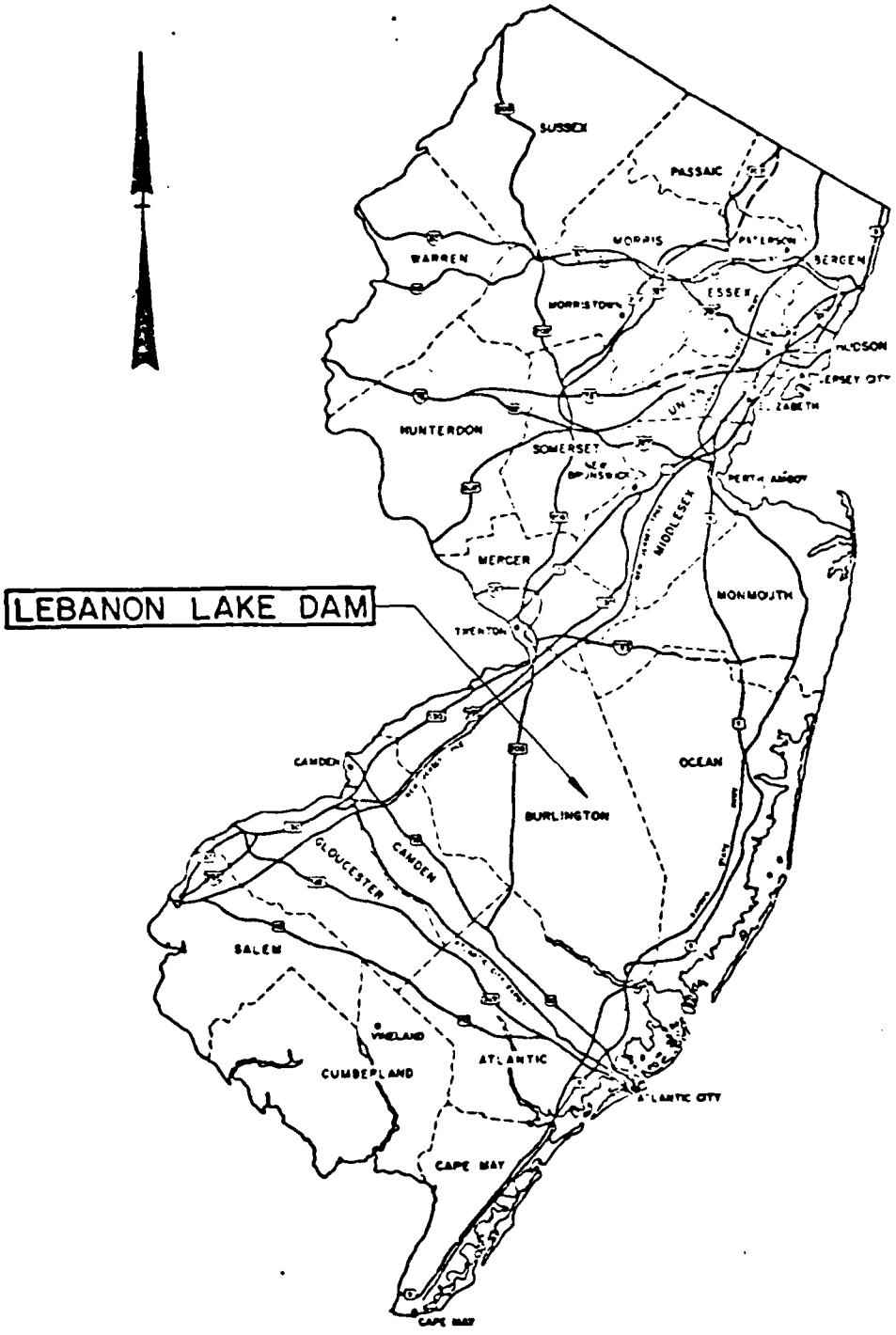
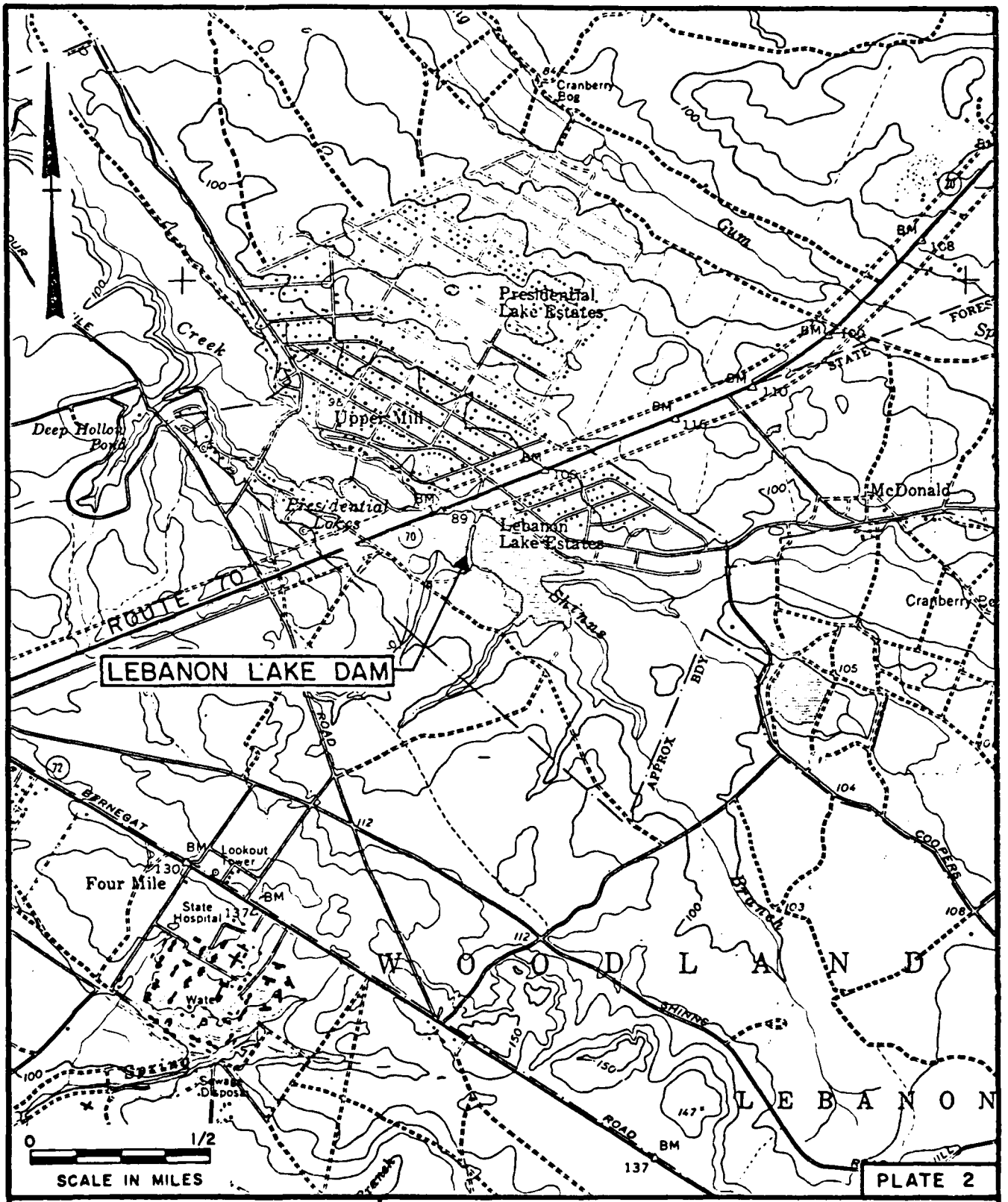


PLATE 1

STORCH ENGINEERS FLORHAM PARK, NEW JERSEY	INSPECTION AND EVALUATION OF DAMS KEY MAP LEBANON LAKE DAM
DIVISION OF WATER RESOURCES N.J. DEPT. OF ENVIR. PROTECTION TRENTON, NEW JERSEY	SCALE: NONE DATE: FEB. 1981



STORCH ENGINEERS
FLORHAM PARK, NEW JERSEY

DIVISION OF WATER RESOURCES
N.J. DEPT. OF ENVIR. PROTECTION
TRENTON, NEW JERSEY

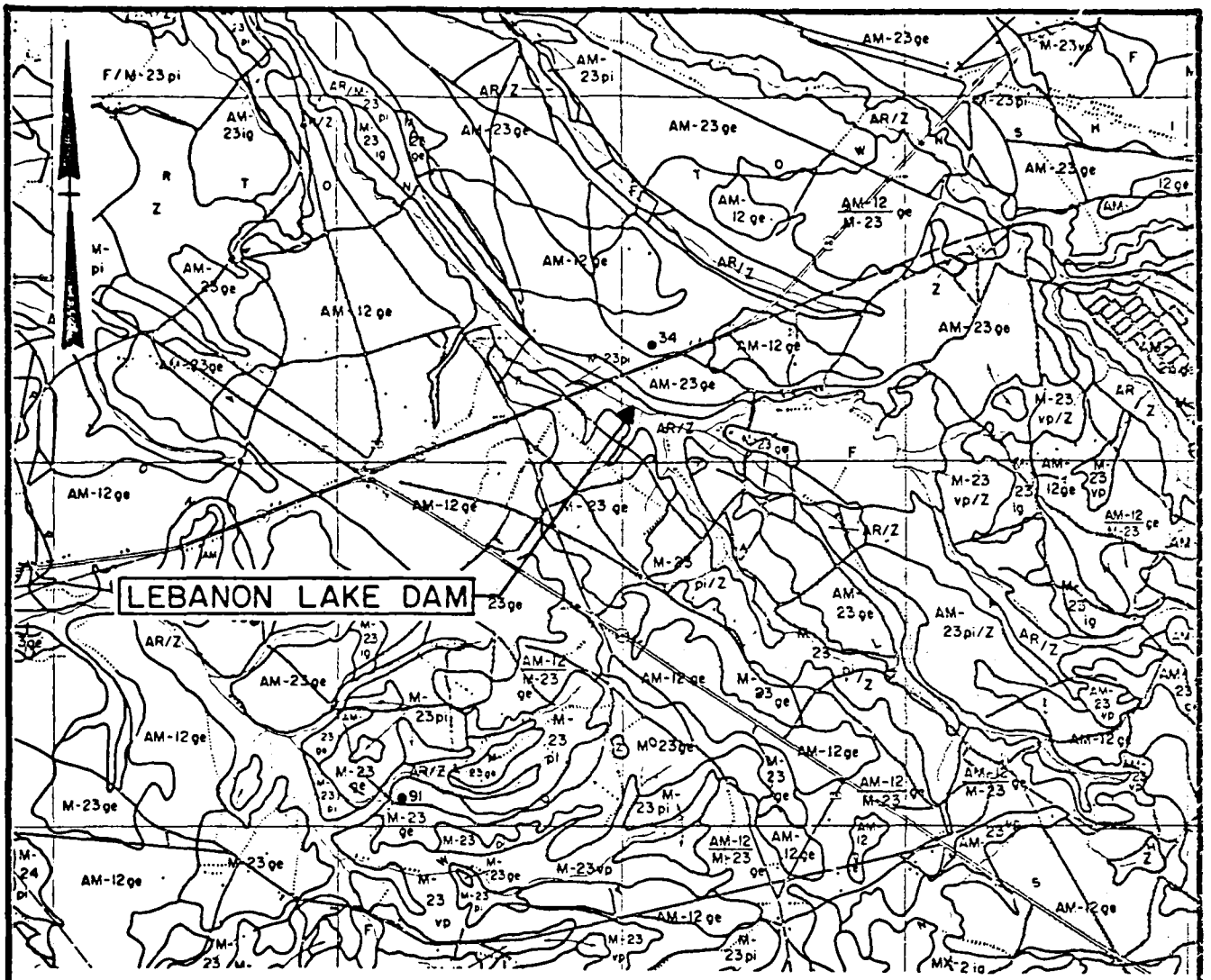
INSPECTION AND EVALUATION OF DAMS

VICINITY MAP

LEBANON LAKE DAM

SCALE: AS SHOWN

DATE: FEB. 1981



Legend

AR/Z — Recent alluvial deposits in poorly drained swampy conditi

AM-23 — Irregular mantle of stratified alluvial material, associated on the Geologic Map of New Jersey with the Bridgetown formatio.

Note: Information taken from Rutgers University, Soil Survey of New Jersey, Report No. 20, Burlington County, May 1955 and Geologic Map of New Jersey prepared by J.V. Lewis and H. Kummel 1910-1912, revised by H.B. Kummel 1931 and M. Johnson 1950.

PLATE 3

STORCH ENGINEERS
FLORHAM PARK, NEW JERSEY.

DIVISION OF WATER RESOURCES
N.J. DEPT. OF ENVIR. PROTECTION
TRENTON, NEW JERSEY.

INSPECTION AND EVALUATION OF DAMS

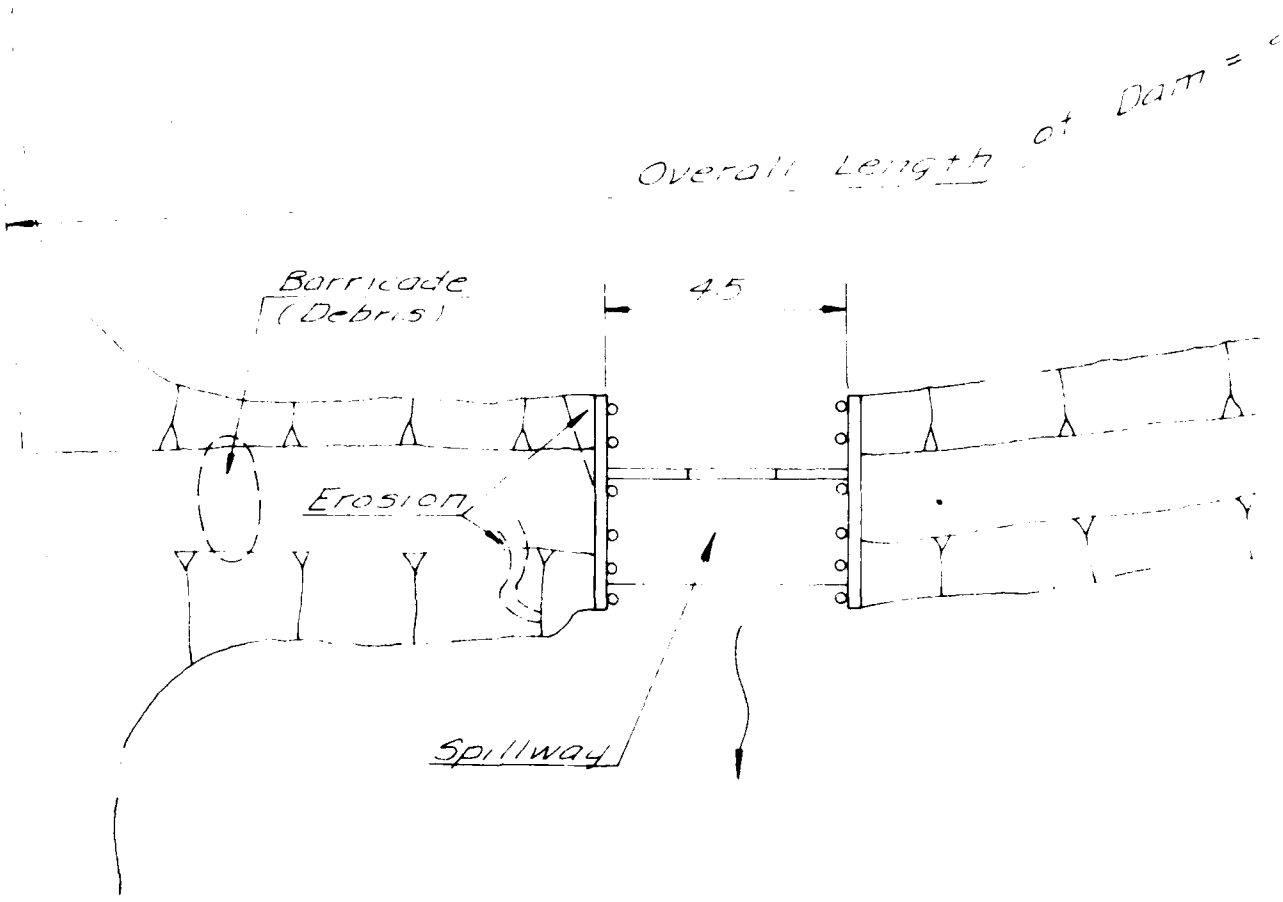
SOIL MAP

LEBANON LAKE DAM

SCALE: NONE

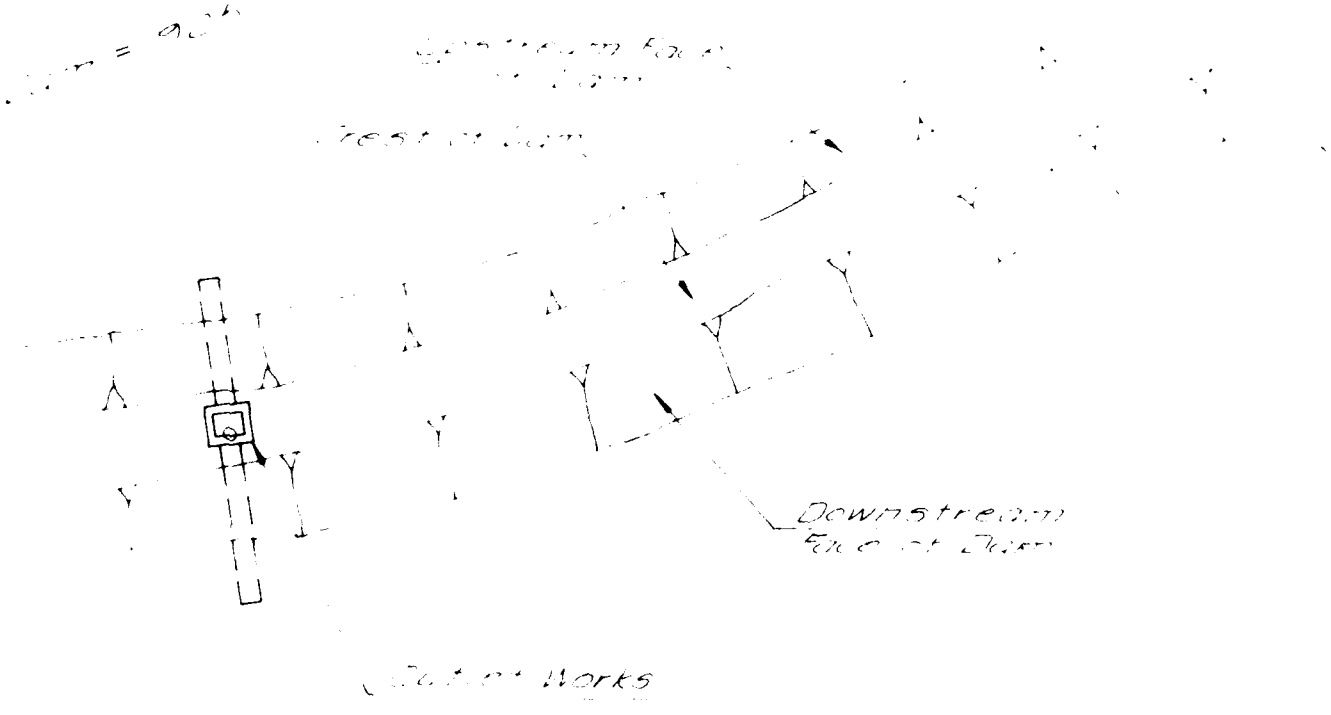
DATE: FEB.1981

LEBANON LAKE



Note:
Information taken from
field inspection April 27, 1982.

N LAKE



Water Works

2

PLATE 4

STORCH ENGINEERS FLORHAM PARK, NEW JERSEY	DIVISION OF WATER RESOURCES N.J. DEPT. OF ENVIR. PROTECTION TRENTON, NEW JERSEY

INSPECTION AND EVALUATION OF DAMS

GENERAL PLAN

LEBANON LAKE DAM

ID N.J. 00812	SCALE NOT TO SCALE
	DATE APRIL, 98

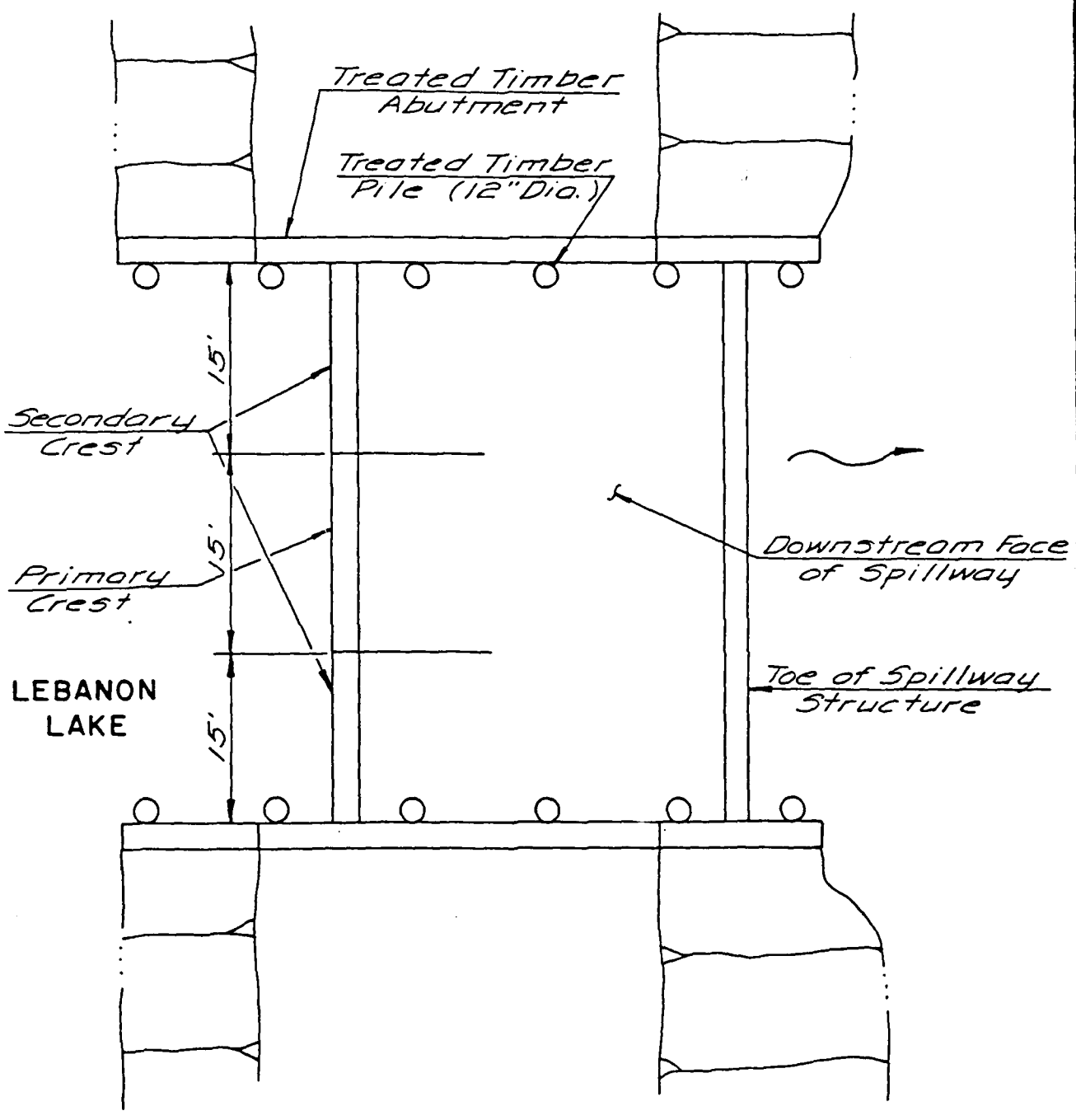


PLATE 5

STORCH ENGINEERS
FLORHAM PARK, NEW JERSEY

DIVISION OF WATER RESOURCES
N.J. DEPT. OF ENVIR. PROTECTION
TRENTON, NEW JERSEY

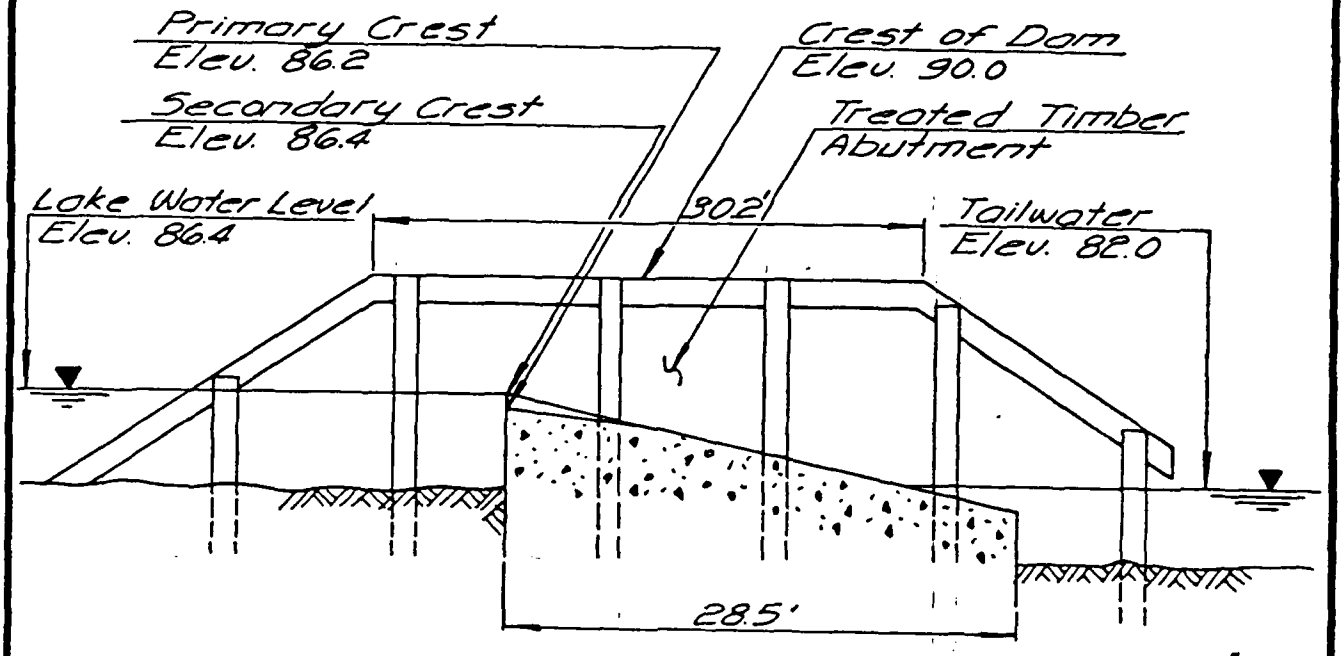
INSPECTION AND EVALUATION OF DAMS

SPILLWAY PLAN
LEBANON LAKE DAM

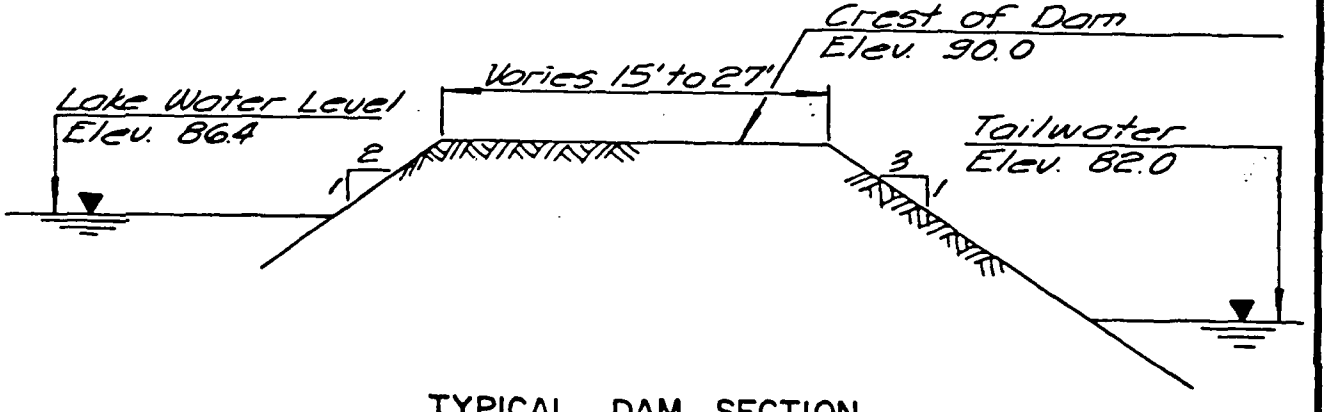
I. D. N.J. 00812

SCALE: NONE

DATE: APRIL, 1981



SPILLWAY SECTION

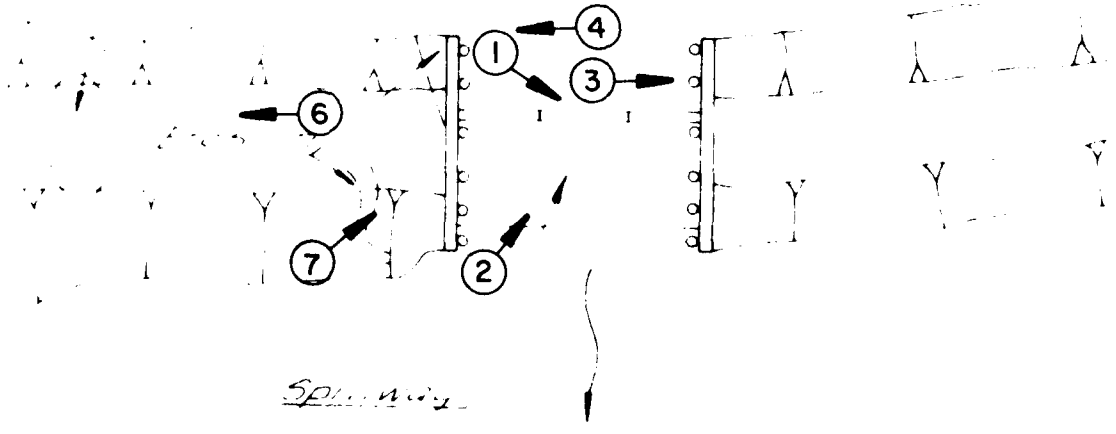


TYPICAL DAM SECTION

PLATE 6

STORCH ENGINEERS FLORHAM PARK, NEW JERSEY	INSPECTION AND EVALUATION OF DAMS SECTIONS -LEBANON LAKE DAM
DIVISION OF WATER RESOURCES N.J. DEPT. OF ENVIR. PROTECTION TRENTON, NEW JERSEY	I.D. N.J. 00812 — SCALE: NONE DATE: FEB, 1981

LEBANON LAKE



OVERVIEW

NON LAKE

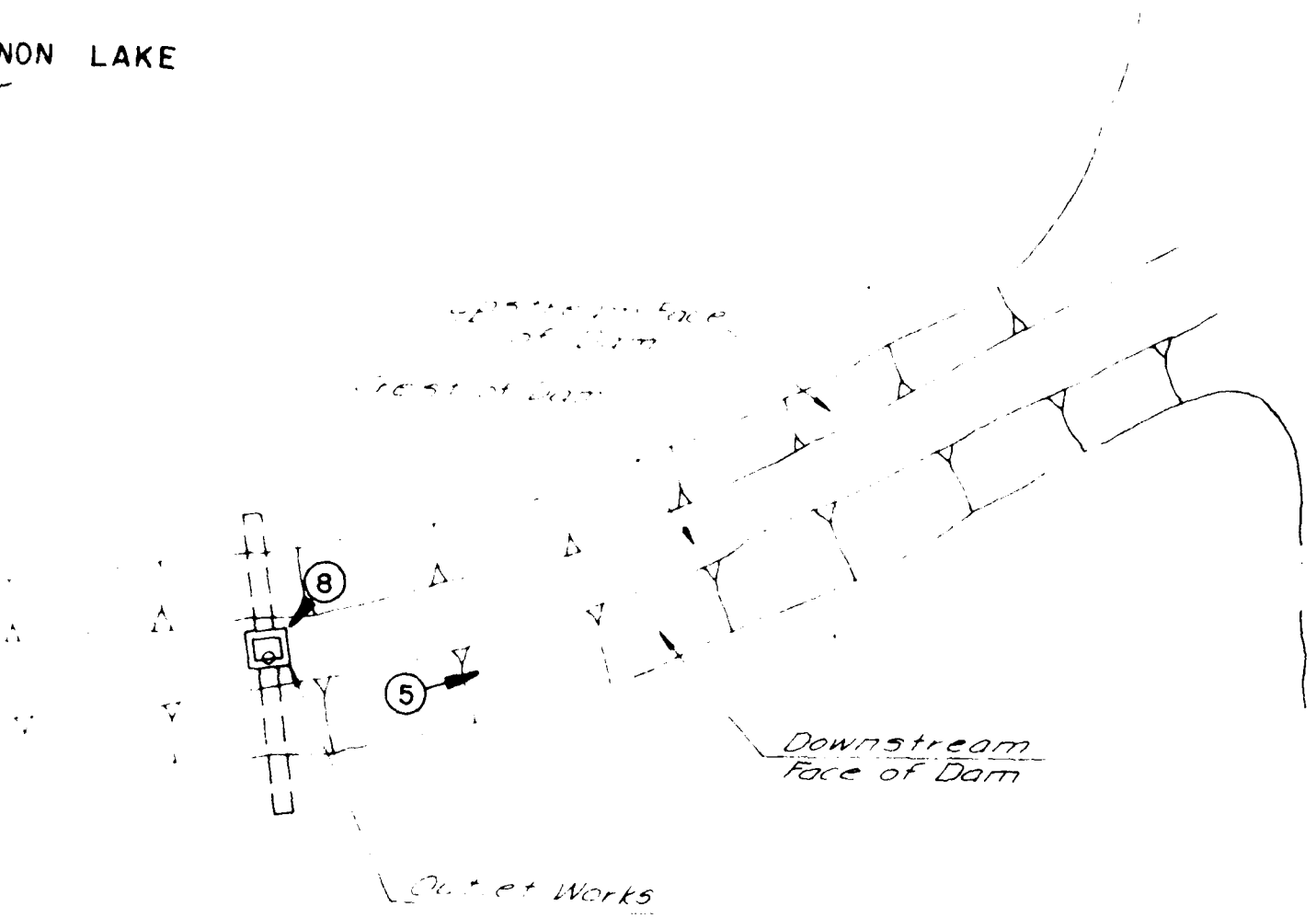


PLATE 7

STORCH ENGINEERS FLORHAM PARK, NEW JERSEY	DIVISION OF WATER RESOURCES N.J. DEPT. OF ENVIR. PROTECTION TRENTON, NEW JERSEY

INSPECTION AND EVALUATION OF DAMS

PHOTO LOCATION PLAN
LEBANON LAKE DAM

I.D. N.J. 00812	SCALE: NOT TO SCALE
	DATE: APRIL, 1981

2

APPENDIX 1

Check List - Visual Inspection

Check List - Engineering Data

Check List

Visual Inspection

Phase I

Name of Dam Lebanon Lake Dam County Burlington State N.J. Coordinators NJDEP

Date(s) Inspection 4/27/81 Weather P. Sunny Temperature 65°F.

Pool Elevation at time of Inspection 86.4 M.S.L. Tailwater at Time of Inspection 82.0 M.S.L.

Inspection Personnel:

John Gribbin

Richard McDermott

Charles Osterkorn

John Gribbin Recorder

Owner's representative not present

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
GENERAL	Embankment material appeared sandy. Crest bare and upstream and downstream sides contained trees (1" to 8") and sparse grass.	Crest should be stabilized. Trees should be removed.
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Generally stable with some erosion at junction with right side of spillway.	Eroded area should be stabilized.
ANY NOTICEABLE SEEPAGE	None observed.	Entire toe of dam submerged by tailwater.
STAFF GAGE AND RECORDER	None observed.	
DRAINS	None observed.	

EMBANKMENT

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None observed.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None observed.	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Wave erosion observed along upstream face at water line. Erosion gully on downstream side about 8' right of spillway (due to runoff). Erosion at junction of embankment and right spillway training wall.	Eroded areas should be filled and stabilized.
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Vertical: generally level. Horizontal: slightly curved.	
RIPRAP	None observed.	

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SURFACES IN OUTLET CONDUIT	Conduit buried and submerged and not observed.	
INTAKE STRUCTURE	N.A.	
OUTLET STRUCTURE	N.A.	
OUTLET CHANNEL	N.A.	
GATE AND GATE HOUSING	Square concrete manhole appeared to be in satisfactory condition. Gate not observed, manhole flooded to a height equal to upstream water level. Gate operating mechanism and stem were rusty but appeared sound.	Operational adequacy of outlet works should be determined and repaired if necessary.

SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
WEIR	Conc. weir appeared to be in satisfactory condition.	
APPROACH CHANNEL	Formed by timber training walls.	
DISCHARGE CHANNEL	Spillway discharges directly into downstream lake.	
TRAINING WALLS	Treated timber training walls braced by treated timber piles appeared to be in satisfactory condition. A portion of the timber cap on the left training wall was rotted.	Rotted timber cap should be repaired.

INSTRUMENTATION

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None observed.	
OBSERVATION WELLS	None observed.	
WEIRS	None observed.	
PIEZOMETERS	None observed.	
OTHER		

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Shore slopes generally thickly wooded with flat to moderate grades (1% to 5%). Beach area on right side near dam.	
SEDIMENTATION	Unknown.	
STRUCTURES ALONG BANKS	Firehouse building on right shore.	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTION, DEBRIS, ETC.)	Small lake immediately downstream from dam. Lake shores thickly wooded. At downstream end (about 500' from subject dam) embankment for N.J. Route 70 is located. Concrete bridge with timber spillway located in embankment. Downstream from Route 70 is additional lake.	
SLOPES	Lake shores between subject dam and Route 70 generally flat. Lake shores downstream from Route 70 generally moderate.	
STRUCTURES ALONG BANKS	No structures observed between subject dam and Route 70. A few dwellings were observed along right side of lake downstream from Route 70. Dwellings greater than 8' above water level.	

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM		REMARKS
DAM -	PLAN	Not Available
	SECTIONS	
SPILLWAY -	PLAN	Not Available
	SECTIONS	
	DETAILS	
OPERATING EQUIPMENT PLANS & DETAILS		Not Available
OUTLETS -	PLAN	Not Available
	DETAILS	
	CONSTRAINTS	
	DISCHARGE RATINGS	
HYDRAULIC/HYDROLOGIC DATA		Not Available
RAINFALL/RESERVOIR RECORDS		Not Available
CONSTRUCTION HISTORY		Not Available
LOCATION MAP		Not Available

ITEM	REMARKS
DESIGN REPORTS	Not Avialable
GEOLOGY REPORTS	Not Available
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM INSTABILITY SEEPAGE STUDIES	Not Available
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	Not Available
POST-CONSTRUCTION SURVEYS OF DAM	Not Available
BORROW SOURCES	Not Available

ITEM	REMARKS
MONITORING SYSTEMS	Not Available
MODIFICATIONS	Not Available
HIGH POOL RECORDS	Not Avialable
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	Not Available
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	Not Available
MAINTENANCE OPERATION RECORDS	Not Available

APPENDIX 2

Photographs

PHOTO 1
UPSTREAM SIDE OF SPILLWAY

PHOTO 2
DOWNSTREAM SIDE OF SPILLWAY

LEBANON LAKE DAM
30 APRIL 1981

PHOTO 3
LEFT SPILLWAY ABUTMENT

PHOTO 4
RIGHT SPILLWAY ABUTMENT

LEBANON LAKE DAM
30 APRIL 1981

PHOTO 5
CREST AND DOWNSTREAM SIDE OF EMBANKMENT

PHOTO 6
BARRICADE NEAR RIGHT END OF DAM

LEBANON LAKE DAM
30 APRIL 1981

PHOTO 7

EROSION ON DOWNSTREAM SIDE OF EMBANKMENT - RIGHT OF SPILLWAY

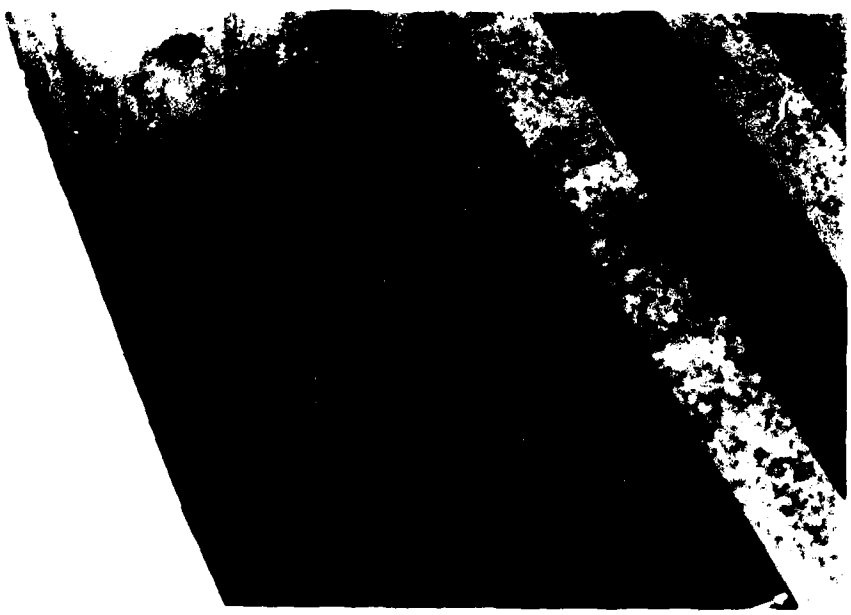


PHOTO 8

OUTLET WORKS MANHOLE SHOWING GATE OPERATING STEM

LEBANON LAKE DAM

30 APRIL 1981

APPENDIX 3

Engineering Data

CHECK LIST

HYDROLOGIC AND HYDRAULIC DATA

ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: Wooded and swampy

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 86.4 (110 arce-feet)

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): N.A.

ELEVATION MAXIMUM DESIGN POOL: 90.1

ELEVATION TOP DAM: 90.0

SPILLWAY CREST:

a. Elevation 86.2 (Primary), 86.4 (Secondary)

b. Type Triangular section - vertical upstream face

c. Width N.A.

d. Length 15 feet (Primary), 30 feet (Secondary)

e. Location Spillover Center of dam

f. Number and Type of Gates None

OUTLET WORKS:

a. Type Gated 48-inch pipe

b. Location near center of dam

c. Entrance Invert Unknown

d. Exit Invert Unknown

e. Emergency Draindown Facilities: Open gate

HYDOMETEOROLOGICAL GAGES: None

a. Type N.A.

b. Location N.A.

c. Records N.A.

MAXIMUM NON-DAMAGING DISCHARGE:

(Lake Stage Equal to Top of Dam) 937 c.f.s.

APPENDIX 4

Hydraulic/Hydrologic Computations

STORCH ENGINEERS

Project LEBANON LAKE DAM

Sheet 1 of 11

Made By JLP Date 4-28-81

Chkd By JG Date 5/1/81

HYDROLOGY

Unit hydrograph for Lebanon Lake Dam will be developed using Clark's parameters calculated from the following equations:

$$TC + R = 21.0\,(DA/S)^{0.22}\,(ST)^{0.33}\,(1.0 + 0.3\,(I))^{-0.28}$$

$$TC = 6.82\,(DA/S)^{0.17}\,(ST)^{0.41}\,(1.0 + 0.3\,(I))^{-0.42}$$

where: I = % Impervious

DA = Drainage Area (Sq. Mi.)

S = Average channel slope between the points 10 and 85 percent of the distance upstream from the outflow point (dam) to the watershed boundary. (ft./mi.)

S_t = % Storage Area (Lakes and Swamps)

1. Drainage Area: 10.66 SQ. MI.

HYDROLOGY (con't.)

2. Average Channel Slope

Total Length = 7.16 miles

Elevation at a distance of 6.1 miles from the dam = 140.0 ft.

Elevation at a distance of 0.7 miles from the dam = 90.0 ft.

Average Channel Slope = $\frac{140-90}{6.1-0.7} = 9.26$ ft/mi.

3. Storage Area = 0.63 SQ. MI.

$S_t = \frac{0.63}{10.66} \times 100 = 5.9\%$

4. Population:

APPROX. 1000

Population Density = $\frac{1000}{10.66} = 94$ /SQ. MI.

HYDROLOGY (con't.)

4. Impervious Cover Index, $I = 0.117[D]^{0.792-0.039\log_{10} D}$ from Special Report 38 by U.S.G.S. with NJDEP 1974

$= 0.117[94]^{0.792-0.039\log_{10} 94}$

$= 0.117[94]^{0.792-0.077}$

$= 0.117[94]^{0.715}$

$= 3.0\%$

5. Unit Hydrograph Parameters

$$T_c + R = 21.0 (DA/S)^{0.22} (S_L)^{0.33} (1.0+0.3\,I)^{-0.28}$$

$$= 21.0 \left(\frac{10.66}{9.26}\right)^{0.22} (5.9)^{0.33} (1.0 + 0.3 \times 3.0)^{-0.28}$$

$$= 21.0 (1.15)^{0.22} (5.9)^{0.33} (1.9)^{-0.28}$$

$$= 21 (1.03)(1.8)(0.836)$$

$$T_c + R = 32.5$$

$$T_c = 6.82 (DA/S)^{0.17} (ST)^{0.41} (1.0+0.3(I))^{-0.42}$$

$$= 6.82 \left(\frac{10.66}{9.26}\right)^{0.17} (5.9)^{0.41} (1.0+0.3 \times 3.0)^{-0.42}$$

$$= 6.82 (1.15)^{0.17} (5.9)^{0.41} (1.9)^{-0.42}$$

$$= 6.82 (1.02)(2.07)(0.76)$$

$$= 10.9$$

HYDROLOGY (con't)

T_c = 10.9 HRS

$T_c + R$ = 32.5

10.9 + R = 32.5

R = 21.6 HRS.

FOR COMPUTER INPUT:

T_c = 10.9 HRS

R = 21.6 HRS

STORCH ENGINEERS

Project LEBANON LAKE DAM

Sheet 5 of 11

Made By CLO Date 4-28-81

Chkd By JG Date 5/1/81

LAKE STORAGE VOLUME

ELEVATION (ft.)	AREA (acres)
76.0	0
86.4	31.8
90.0	65
100.0	555

HEC-1-DAM COMPUTER PROGRAM WILL DEVELOP STORAGE CAPACITY FROM WATER SURFACE AREA AND ELEVATIONS. INFORMATION TAKEN FROM U.S.G.S. QUADRANGLE BROWNS MILLS, N.J.

PRECIPITATION

24 HOUR, 100-YEAR RAINSTORM

DISTRIBUTION FOR LEBANON LAKE DAM

TIME (HR.)	RAIN (IN.)
1	0.08
2	0.08
3	0.08
4	0.08
5	0.08
6	0.08
7	0.09
8	0.09
9	0.18
10	0.18
11	0.18
12	0.19
13	0.30
14	0.30
15	0.80
16	3.00
17	0.40
18	0.30
19	0.19
20	0.18
21	0.09
22	0.09
23	0.08
24	0.08

7.20 inches

From U.S. Weather Bureau TP-40.

HYDRAULICS

THE SPILLWAY AT LEBANON LAKE DAM CONSISTS OF A TWO STAGE CONCRETE TRIANGULAR SHAPED WEIR WITH A VERTICAL UPSTREAM FACE. THE PRIMARY CREST HAS AN EFFECTIVE LENGTH OF 15 FEET AND A CREST ELEVATION OF 86.2. THE SECONDARY CREST HAS AN EFFECTIVE LENGTH OF 28 FEET AND A CREST ELEVATION OF 86.4 DISCHARGE WILL BE CALCULATED USING THE FOLLOWING WEIR FORMULA:

$$Q = C L H^{3/2}$$

Where: C = discharge COEFFICIENT

L = EFFECTIVE LENGTH OF SPILLWAY

H = TOTAL HEAD ON SPILLWAY

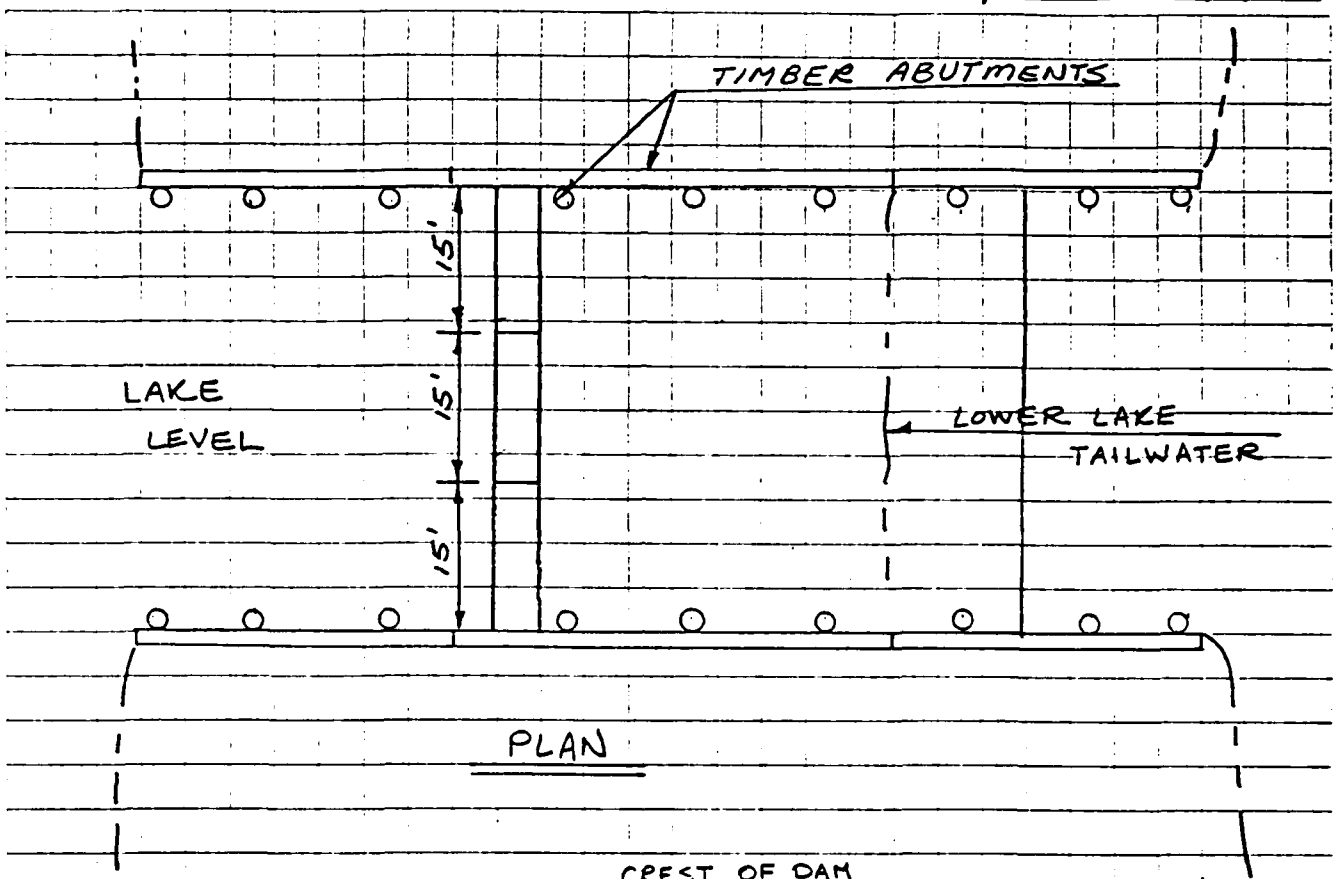
STORCH ENGINEERS

Sheet 8 of 11

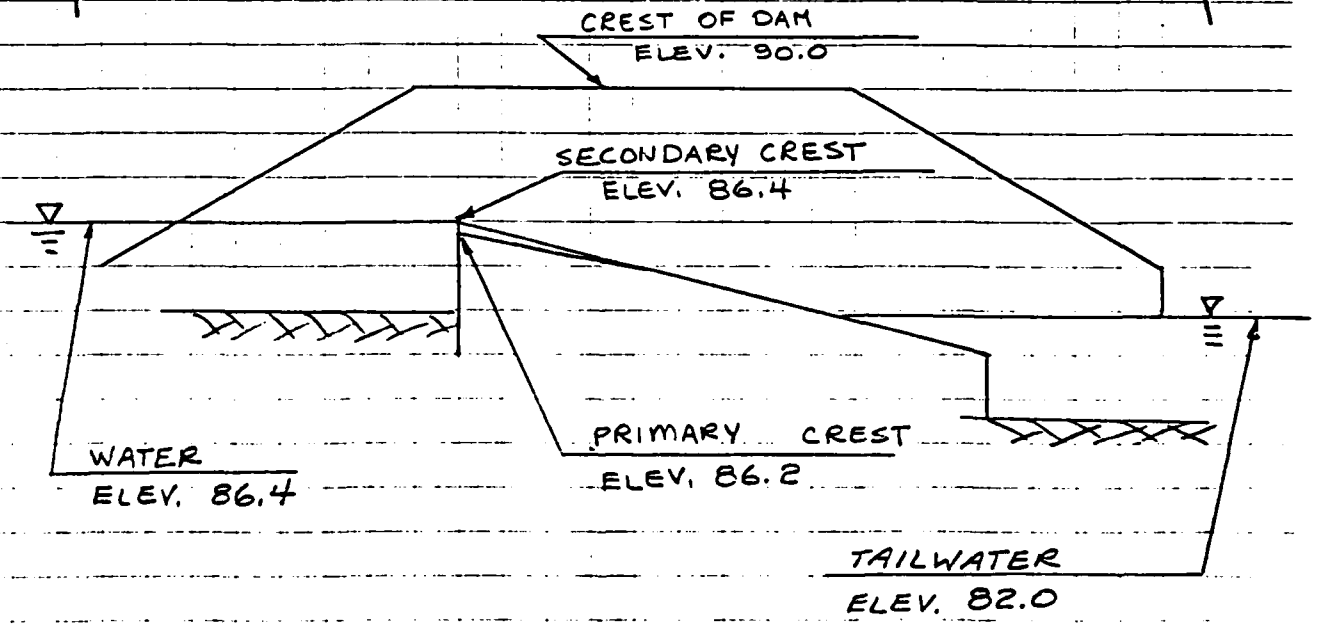
Project LEBANON LAKE DAM

Made By CLO Date 4-28-81

Chkd By JG Date 5/1/81



PLAN



SECTION

STORCH ENGINEERS

Sheet 9 of 11

Project LEBANON LAKE DAM

Made By CLO Date 4-28-81

Chkd By JG Date 5/1/81

SPILLWAY
STAGE DISCHARGE TABULATION

ELEV. (ft)	PRIMARY SPILLWAY ELEV 86.2, L=15'		SECONDARY SPILLWAY ELEV. 86.4, L_{EFF} = 28'		Q TOTAL (cfs)
	H (ft)	Q * (cfs)	H (ft)	Q * (cfs)	
86.2	0	0	0	0	0
86.4	0.2	4	0	0	4
87.0	0.8	33	0.6	40	73
88.0	1.8	112	1.6	176	288
89.0	2.8	218	2.6	364	582
90.0	3.8	344	3.6	593	937
91.0	4.8	489	4.6	856	1345
92.0	5.8	650	5.6	1150	1800
93.0	6.8	825	6.6	1472	2297

* C = 3.10 from Brater & King - Handbook of HYDRAULICS TABLE 5-7 TRIANGULAR SHAPED WEIR WITH VERTICAL UPSTREAM FACE SLOPE OF DOWNSTREAM FACE 5:1.

STORCH ENGINEERS

Sheet 10 of 11

Project LEBANON LAKE DAM

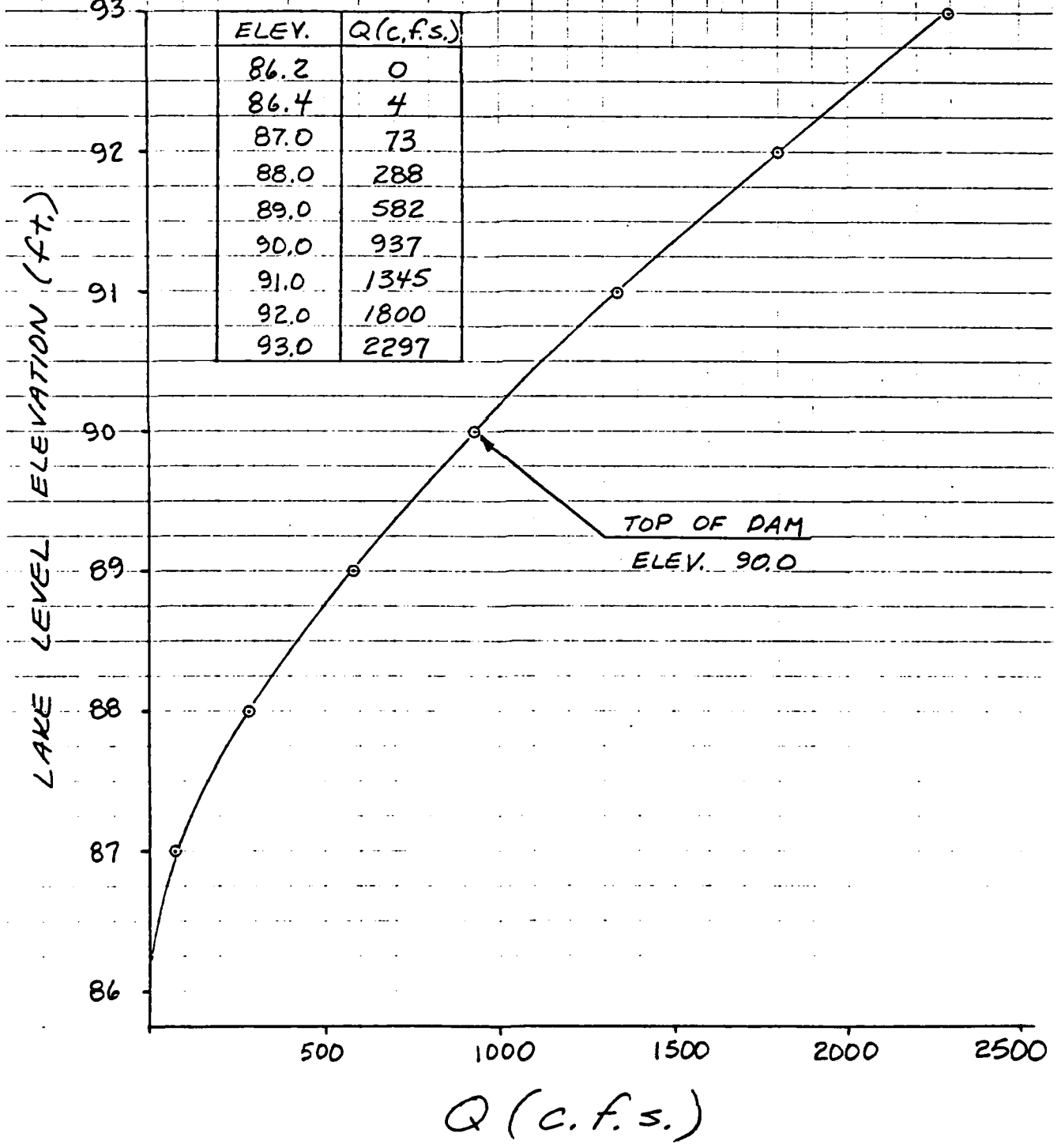
Made By CLO Date 4-28-81

Chkd By JG Date 5/1/81

SPILLWAY

STAGE DISCHARGE CURVE

ELEV.	Q (c.f.s.)
86.2	0
86.4	4
87.0	73
88.0	288
89.0	582
90.0	937
91.0	1345
92.0	1800
93.0	2297



STORCH ENGINEERS

Sheet 11 of 11

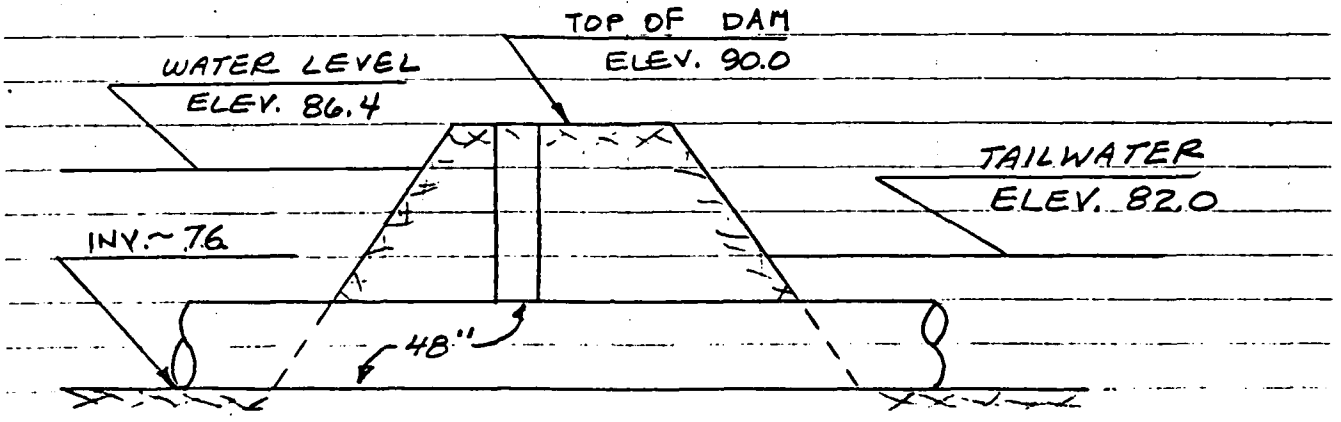
Project LEBANON LAKE DAM

Made By CLO Date 4-28-81

Chkd By JG Date 5/1/81

DRAWDOWN

DISCHARGE THROUGH 48" DIAMETER OUTLET WORKS BASED UPON CHART NO. 11 FROM THE "HYDRAULIC CHARTS FOR THE SELECTION OF HIGHWAY CULVERTS" ASSUMING OUTLET CONTROL.



$$H_{AVER} = \frac{86.4 - 82.0}{2} = 2.2'$$

FROM CHART $Q = 90$ cfs

$$\text{DRAWDOWN TIME} = \frac{\text{STORAGE AT SPILLWAY}}{\text{AVERAGE DISCHARE - INFLOW}}$$

$$= \frac{110 \times 43560}{(90 - 21)\,3600}$$

$$= 19 \text{ HOURS}$$

HEC - 1 - DAM PRINTOUT

Overtopping Analysis

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 1.00
HYDROGRAPH AT	LAKE	10.66 (27.61)	1	1032. (29.23)(
ROUTED TO	DAM	10.66 (27.61)	1	985. (27.89)(

1

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1		INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
	ELEVATION	86.40	86.20	90.00
	STORAGE	110.	104.	281.
	OUTFLOW	4.	0.	937.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	90.05	.05	284.	985.	3.00	28.00	0.00

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTE DISCHARGE THRU DAM

ISTAO	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
DAM	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP		LSTR
0.0	0.000	0.00	1	1	0	0		0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-86.	-1

STAGE	86.20	86.40	87.00	88.00	89.00	90.00	91.00	92.00	93.00
FLOW	0.00	4.00	73.00	288.00	582.00	937.00	1345.00	1800.00	2297.00
SURFACE AREA=	0.	32.	65.	555.					
CAPACITY=	0.	110.	281.	2981.					
ELEVATION=	76.	86.	90.	100.					

CREL	SPWID	COOW	EXPW	ELEVL	COOL	CAREA	EXPL
86.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COOD	EXPD	DAMWID
90.0	2.8	1.5	880.

PEAK OUTFLOW IS 985. AT TIME 28.00 HOURS

NATIONAL DAM SAFETY PROGRAM
LEBANON LAKE DAM, NEW JERSEY
100 YEAR STORM ROUTING

JOB SPECIFICATION

NO	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
100	1	0	0	0	0	0	0	4	0
			JOPER	NWT	LROPT	TRACE			
			5	0	0	0			

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 1 LRTIO= 1

RTIOS= 1.00

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

INFLOW HYDROGRAPH TO LEBANON LAKE DAM

ISTAO	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
LAKE	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDO	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
0	0	10.66	0.00	10.66	0.00	0.000	0	1	0

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOR	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.50	.15	0.00	0.00

UNIT HYDROGRAPH DATA
TC= 10.90 R= 21.60 NTA= 0

RECESSION DATA
STRTQ= -1.00 QRCSN= -.05 RTIOR= 2.00

UNIT HYDROGRAPH100 END-OF-PERIOD ORDINATES, LAG= 10.65 HOURS, CP= .38 VOL= .99

6.	23.	48.	77.	110.	146.	179.	207.	229.	243.
248.	242.	231.	221.	211.	201.	192.	184.	175.	167.
160.	153.	146.	139.	133.	127.	121.	116.	110.	105.
101.	96.	92.	88.	84.	80.	76.	73.	69.	66.
63.	60.	58.	55.	53.	50.	48.	46.	44.	42.
40.	38.	36.	35.	33.	32.	30.	29.	28.	26.
25.	24.	23.	22.	21.	20.	19.	18.	17.	17.
16.	15.	14.	14.	13.	13.	12.	11.	11.	10.
10.	9.	9.	9.	8.	8.	8.	7.	7.	7.
6.	6.	6.	5.	5.	5.	5.	5.	4.	4.

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
						0
		SUM	7.20	4.22	2.98	28402.
			(103.)	(107.)	(76.)	(804.26)

```
1A1                          NATIONAL DAM SAFETY PROGRAM
 A2                          LEBANON LAKE DAM, NEW JERSEY
 A3                          100 YEAR STORM ROUTING
 B     100       1       0                                                  4
 B1      5
 J       1       1       1
 J1      1
 K       0    LAKE                                                  1
 K1                       INFLOW HYDROGRAPH TO LEBANON LAKE DAM
 M       0       0   10.66           10.66                                  1
 D      24
 D1  0.08    0.08    0.08    0.08    0.08    0.08    0.09    0.09    0.18    0.18
 D1  0.18    0.19    0.30    0.30    0.80    3.00    0.40    0.30    0.19    0.18
 D1  0.09    0.09    0.08    0.08
 T                                                   1.5    0.15
 V    10.9    21.6       0
 X    -1.0   -0.05     2.0
 K       1     DAM                                           1
 K1                          ROUTE DISCHARGE THRU DAM
 Y                                       1       1
 Y1      1                                                -86.4      -1
 Y4   86.2    86.4    87.0    88.0    89.0    90.0    91.0    92.0    93.0
 Y5      0       4      73     288     582     937    1345    1800    2297
 $A      0    31.8    65.0   555.0
 $E   76.0    86.4    90.0   100.0
 $$   86.2
 $D   90.0    2.63     1.5     880
 K       99
```

APPENDIX 5

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